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(21) International Application Number: PCT/GB96/00707 (22) International Filing Date: 25 March 1996 (25.03.96) (30) Priority Data: 9506214.7 27 March 1995 (27.03.95) GB (71) Applicant (for all designated States except US): ULTRA ELECTRONICS LIMITED [GB/GB]; Bridport Road, Greenford, Middlesex UB6 8UA (GB). (72) Inventor; and (75) Inventor/Applicant (for US only): BAXENDALE, John, Edward [GB/GB]; Waverley House, Hampshire Road, Granby Estate, Weymouth, Dorset DT4 9XD (GB). (74) Agent: HOGG, Jeffery, Keith; Withers & Rogers, 4 Dyer's Buildings, Holborn, London WC1N 2JT (GB).		(81) Designated States: JP, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: IMAGING METHOD USING DEPOSITION OF DOTS OF PLASTIC TO FORM A RELIEF IMAGE <div data-bbox="267 1155 1372 1606" data-label="Image"> </div> (57) Abstract <p>A method of forming an image comprises depositing pixels or dots of a plastics material (7) of differing thickness or texture on a surface (4) so as to form a relief or textured image in the surface. The plastics material can be transferred to the surface (4) by thermal transfer from a carrier film.</p>		

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Imaging method using deposition of
dots of plastic to form a relief image.

Technical Field

This invention relates to a method and apparatus for forming an image on a surface, and articles on which such images have been formed.

Thermal transfer printing is a well known printing technique, whereby a dye, resin wax or similar transferable pigments are transferred from a thin carrier film to a receiver media by means of thermal impulses from a thermal array printhead. The pigments may be any colour but are commonly black, yellow, cyan or magenta.

In this process, the thermal array printhead comprises a linear array of several hundred small heater elements, in intimate contact with the carrier film, the pigmented surface of which is pressed against the receiver media.

When selected heater elements on the surface of the thermal printhead are given short pulses of electrical energy, this raises their surface temperature to a value where pigment is transferred from the carrier film to the receiver media to form a pixel or coloured spot on the receiver media. Following this transfer, the carrier film and receiver film are moved relative to the thermal printhead, by a distance equivalent to the diameter of the spot. By a process of

repeating this sequence of heat impulses followed by media movement, any desired image is built up. The cycle times for printing a linear array of pixels or colour spots is generally five milliseconds or less. Half tone images are produced by printing a dither pattern of dots and spaces. ~~True~~ photographic quality images are produced by controlling the energies of the heat impulses in conjunction with a suitable diffusion type of dye film. This type of printing is known as dye sublimation or dye diffusion printing.

In certain applications, such as the printing of colour images onto PVC cards for identity purposes, it is necessary to protect the images from damage due to abrasion and wear. ~~The most common method is for a thin, transparent plastic coating to be applied to the printing media.~~ A special plastic overlay film is used, which consists of a thin carrier film coated with a layer of a clear plastic material. The said material may be transferred to the top surface of the printed receiver media by means of a heated roller, or by means of a thermal printhead, in the same manner as the pigment layer is transferred as described above. Essentially all of the plastic material is transferred to the surface of the receiver media, which results in a glossy finish protective overlay, of maximum thickness, to protect the underlying image.

Disclosure of the Invention

According to the present invention, an image is formed as a

relief or textured image on a surface by depositing pixels or dots of plastics material of differing thickness or texture on said surface.

In particular a method of forming an image on a surface according to the invention consists in using a thermal printhead with multiple heater elements, and a carrier film coated with a layer of plastics material, the heating elements serving to heat the carrier film with the plastics coating in contact with said surface so that the plastics material is transferred to said surface in those areas adjacent to energised heater elements. The heater elements may be energised selectively so that they conduct or attain different levels of heat and cause a variation in the thickness of plastics material transferred to said surface at different points. It is thus possible to produce a desired surface pattern in the form of a relief image.

The heater elements may be energised so that the plastics material is applied as a continuous layer over the whole of an area to be coated, and may serve as a protective coating.

Energisation of the heater elements may be controlled continuously or discretely over a range of energy levels to produce a coating that varies continuously or discretely in thickness over said surface. In one example, each heater element may be energised at one or the other of two energy levels so as to transfer either a maximum thickness or a

lesser thickness, nominally 50% of the plastics material, from the carrier film to said surface.

The plastics material may be a clear plastics material so that another image, such as a printed image, on said surface is visible through the coating. ~~An example might be a clear plastics coating on a plastics identity card or bank/credit card, with the relief image serving as an additional authentication feature.~~

The relief image is most clearly seen in reflected light from a discrete source. An image reading head operating on the basis of reflected light may be provided to read the relief image, typically, if used in an automated image authentication process.

If all of the plastics material in a particular area is transferred from the carrier film to said surface, then the exposed surface of the plastics material will tend to be smooth and shiny compared with the exposed surface of a thinner layer of transferred plastics material, which will be more textured or have a satin appearance.

In an alternative arrangement, the full depth of the plastics material may be transferred for each pixel but selected pixels may then be overheated, thereby giving them a matt or satin appearance, whereas the other areas of the plastics material are smooth and shiny.

The carrier film carrying the plastics material is preferably moved relative to the thermal printhead so as to progressively form the relief image in a similar manner to that when printing the image in the known thermal transfer printing process. If the relief image is applied to a surface carrying an image printed by the thermal transfer process, then the printed image and relief image may be formed in successive steps in a continuous printing process.

Either two separate printheads, may be used, one for each image, or a single common printhead may be used to form both images. In the latter case, the carrier film may carry both the plastics material and the print pigment in successive areas in the feed direction of the film.

The invention is illustrated in the accompanying drawings in which:

Figure 1 is a cross-section of a thermal array printhead as used according to the invention;

Figure 2 illustrates how the printhead of Figure 1 prints an image by depositing pigment on a receiver surface;

Figure 3 is a cross-section of the printed receiver surface of Figure 2 with a protective plastics coating applied to it incorporating a relief image according to the invention; and

Figure 4 is a cross-section of the printed receiver surface of Figure 2 with a protective plastics coating applied to it incorporating a texture image according to the invention.

As shown in Figures 1 and 2, the thermal printhead 1 is in intimate contact with the carrier film 2 and the pigment 3 on the surface of the film is pressed against the receiver layer 4. The carrier film 2 and receiver layer 4 are moved together relative to the printhead 1, and the heater elements 5 aligned along the printhead are selectively energised by electrical pulses to transfer dots or pixels 6 of pigment to the receiver layer 4 in successive lateral rows across the width of the receiver layer.

In a subsequent plastics coating process, which could involve the same printhead 1 or a separate similar printhead, a coating of clear plastics material 7 is transferred to the pigment layer 6 (shown in Figure 3) from a carrier film which passes beneath the printhead with the receiver layer 4 in a similar manner to that shown in Figure 2. Again, the heater elements 5 of the printhead are selectively energised so as to transfer pixels or dots of the plastics material 7 of different thickness to the receiver layer 4 in a continuous manner so that the whole of the pigment layer 6 is coated. Every heater element 5 is energised to form each successive row of pixels or dots of plastics material, but each heater element is energised at either of two different levels so as to transfer either the whole thickness of the plastics

material or only part of the thickness of the plastics film, typically 50%, from the carrier film to the receiver layer. The pattern of the thinner pixels or dots 7' as shown in Figure 3 is determined by a controller controlling energisation of the heater elements, and corresponds to the image that is required to be formed as a relief image in the final plastics coating.

Figure 4 illustrates an alternative embodiment of the present invention. In this arrangement, the heater elements of the print head 5 are controlled between a first and a second heating value. Each heating value causes the entirety of the coating of plastics material 7 to be transferred from the carrier film to the receiver layer 4. However, the first heating value is greater than the second heater value, and the additional heating overworks the clear plastics material and damages its shiny upper layer in order to create regions 10 which are not shiny and may have a matt or satin-like appearance. Thus, a uniformly thick protective layer bearing an image can be deposited onto the receiver layer, and hence over any images printed thereon.

CLAIMS

1. A method of forming an image, characterised by depositing pixels (7') or dots of plastics material (7) of differing thickness or texture on a surface (4) so as to form ~~a relief or textured image on the surface (4)~~.

2. A method as claimed in claim 1, characterised in that a carrier film is provided with a layer of the plastics material (7) and in that a plurality of heater elements (5) are provided on a thermal printhead for heating the carrier film with the plastics material (7) in contact with the surface (4) so that the plastics material (7) is transferred ~~to the surface (4) in those areas adjacent to energised heater elements (5)~~.

3. A method as claimed in claim 2, characterised in that the heater elements (5) are selectively energised to attain different levels of heat and thereby cause a variation in the thickness of the plastics material (7) transferred to said surface at different positions thereof.

4. A method as claimed in claim 3, characterised in that the heater elements (5) are energised so as to deposit a continuous layer of the plastics material (7) over the whole of an area to be coated, such that the plastics material serves as a protective coating.

5. A method as claimed in any one of claims 1 or 4, characterised in that the energisation of the heater elements (5) is controlled continuously over a range of energy levels to produce a coating that varies continuously in thickness over the surface (4).

6. A method as claimed in any one of claims 3 or 4, characterised in that the energisation of the heater elements (5) is controlled discretely to produce a coating that varies substantially discretely in thickness over the surface (4).

7. A method as claimed in claim 6, characterised in that each heater element is energised to one of first and second different energy levels so as to transfer one of a first and second thickness of plastics material to the surface (4), respectively.

8. A method as claimed in any one of the preceding claims, characterised in that the plastics material (7) is clear so that another image on the surface (4) is visible through the plastics material (7) deposited on the surface (4).

9. A method as claimed in any one of the preceding claims, characterised in that a textured image is formed by depositing the full thickness of the plastics material to give a shiny surface and less than the full thickness of the plastics material to provide a matt or satin appearance.

10. A method as claimed in any one of the preceding claims, characterised in that the full thickness of the plastics film is deposited on the surface (4) with selected pixels being over heated so as to give them a matt or satin appearance.

11. A method as claimed in any one of the preceding claims, characterised in that the carrier film is progressively advanced with respect to the print head during the printing process.

12. A surface printed in accordance with the method claimed in any one of the preceding claims.

13. A surface as claimed in claim 12, characterised in that an image is printed onto the surface prior to depositing the plastics material.

14. An identity card printed in accordance with the method as claimed in any one of claims 1 to 11.

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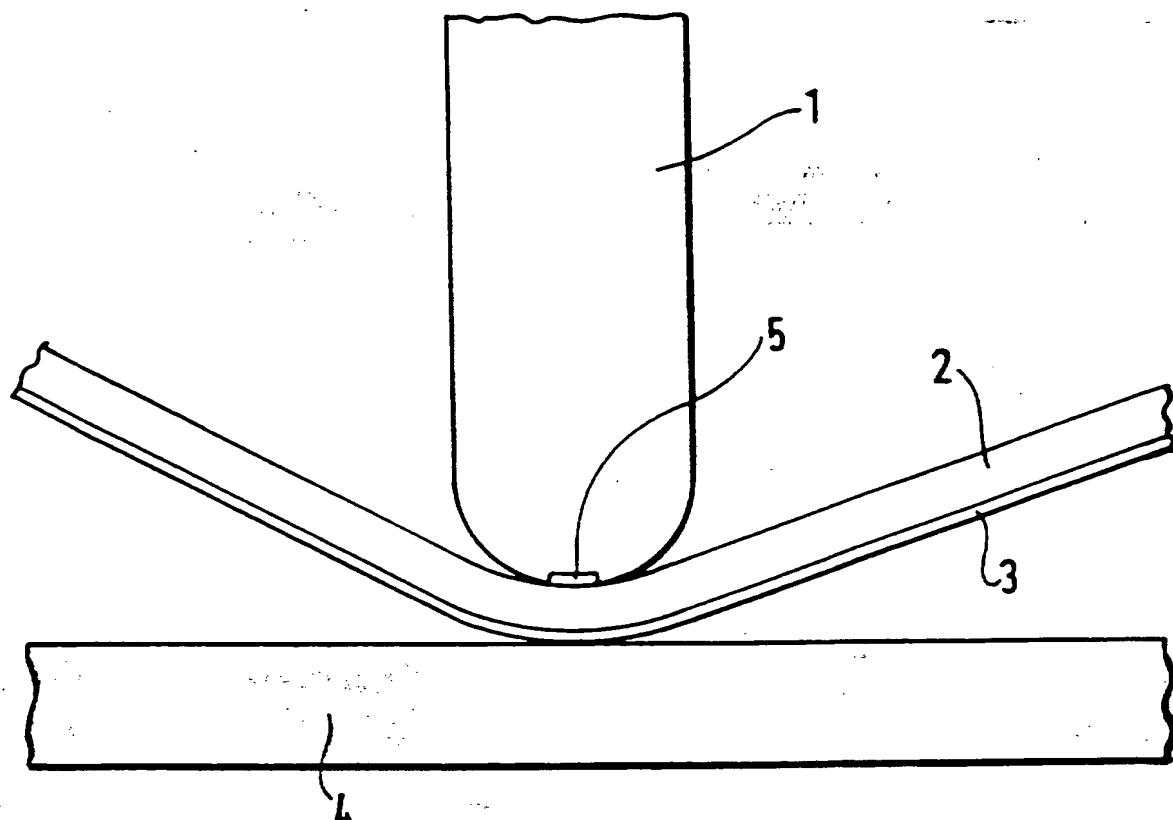


FIG.1.

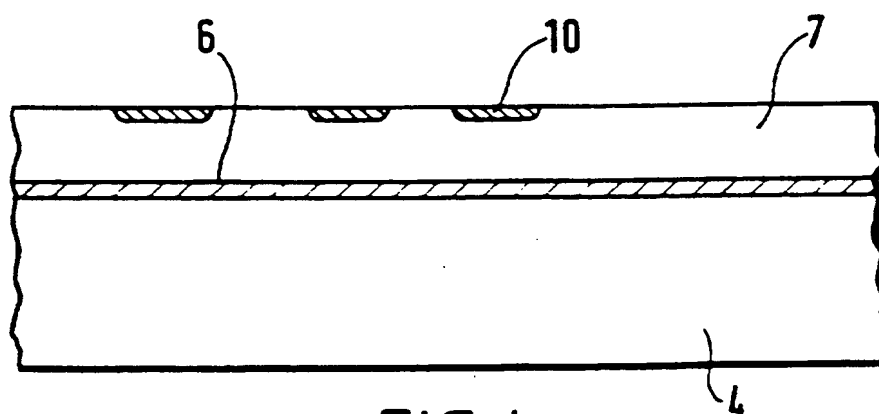


FIG.4.

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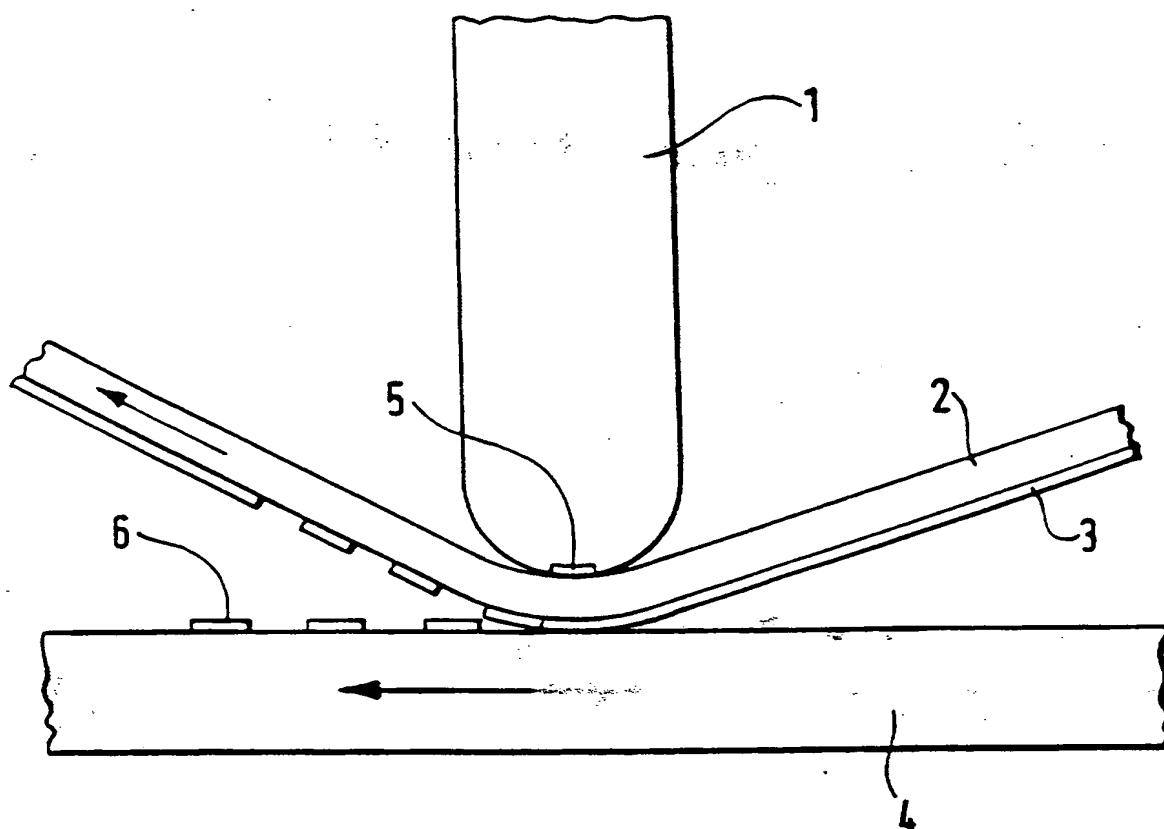


FIG. 2.

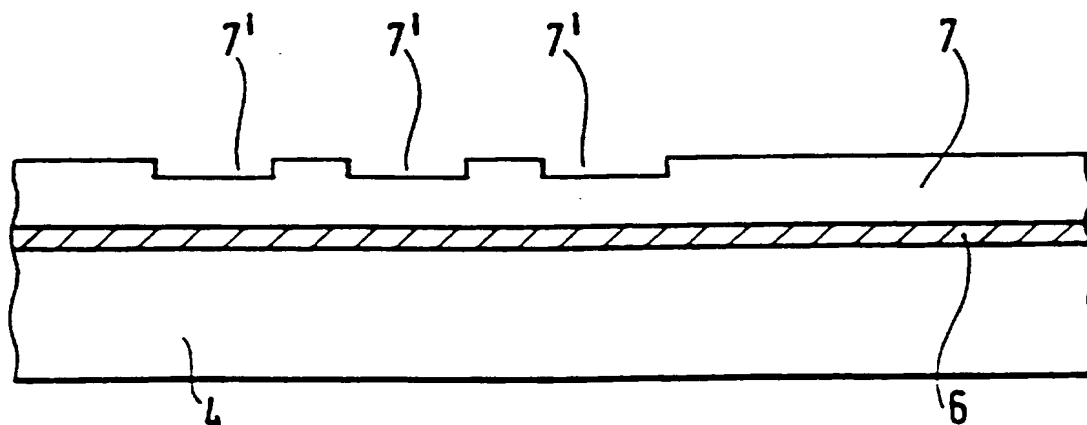


FIG. 3.

INTERNATIONAL SEARCH REPORT

Int. Appl. No.

PCT/GB 96/00707

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 B41M5/38 B41M3/14 B42D15/10 B44C1/17 B41M7/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B41M B42D B44C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 407 615 (DAI NIPPON INSATSU KABUSHIKI KAISHA) 16 January 1991 see page 2, line 20 - page 3, line 34 see page 13, line 16 - line 22 see page 49, line 17 - line 32 see page 11, line 18 - line 36 see claims 1-23; figure 1	1-14
X	US,A,5 387 573 (M.C.S. OLDFIELD ET AL.) 7 February 1995 see column 1, line 63 - column 2, line 18 see column 3, line 65 - column 4, line 15 see claims 1,8	1-14

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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X	<p>JOURNAL OF IMAGING TECHNOLOGY FOR IMAGING SCIENCE AND TECHNOLOGY, vol. 10, no. 2, April 1984, SPRINGFIELD US, pages 57-63, XP002007353 JUN OHYA ET AL.: "Gray-Scale Printing on Plain Paper Using Thermal Ink-Transfer Imaging". see figures 1,3,8,9,11,15; table 1 -----</p>	1,11,12

INTERNATIONAL SEARCH REPORT

Information on patent family members

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